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(71) Applicant(s)

Bayerische Motoren Werke Aktiengesellschaft
(Incorporated in the Federal Republic of Germany)
petuelring 130, 80809 Munich,
Federal Republic of Germany

Robert Bosch GmbH
(Incorporated in the Federal Republic of Germany)
Platz 1, 70442 Stuttgart,
Federal Republic of Germany

ZF Friedrichshafen Aktiengesellschaft
(Incorporated in the Federal Republic of Germany)
Almannsweilerstrasse 25,
88046 Freidrichshafen,
Federal Republic of Germany

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(72) Inventor(s)

Marco Noack
Joachim Berrang
Walter Stroh

(74) Agent and/or Address for Service
Bromhead & Co
37 Great James Street, LONDON,
WC1N 3HB, United Kingdom

(54) Abstract Title

A method of controlling a gearbox wherein vehicle direction is taken into account

(57) A method of controlling a vehicle automatic gearbox comprising a gearbox control unit which receives signals from wheel or gearbox output rotation sensors so that a direction of travel of the vehicle is taken into account in order to avoid critical vehicle and/or gearbox conditions such as vehicle stalling. When on an incline the sensors will indicate a backward movement of the vehicle and the control unit may apply brakes and/or increase engine torque, thereby preventing the vehicle rolling backwards and/or vehicle stalling. The control unit may control the vehicle so that it comes to a stop or slows down to a minimal speed or it may prevent a change to a higher gear when a forward gear is engaged. If a reverse gear is engaged a speed threshold may be increased if it is detected that the vehicle rolls backwards. The automated transmission is for off-road vehicles where an engine stall is critical since it deprives a drive of several supporting function, eg power-assisted steering, power brakes etc, after a short period of time.

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Method and device for controlling a vehicle gearbox

5 The present invention relates to a method and a device for controlling a vehicle gearbox in order to avoid critical vehicle and/or gearbox conditions.

In vehicles equipped with an automatic transmission and in particular in off-road vehicles with an automatic transmission, certain circumstances in concrete situations can lead to 10 critical vehicle and/or gearbox conditions. For example, if a vehicle rolls backwards on an incline, the engine may stall if the downhill force exceeds the drag torque of the gearbox. This is critical above all in case of cross-country drives with off-road vehicles since if the engine stalls the driver can no longer use several supporting functions (such as power-assisted steering, power brake etc.) after a short period of time.

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In contrast, it is the object of the present invention to provide a method and a device for controlling a vehicle gearbox that give the driver security, avoid damage to the vehicle and/or the gearbox and increase the availability of the vehicle. This object is achieved by the features of the claims.

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The present invention is based on the idea of detecting the direction of travel of the vehicle and considering it when controlling the vehicle gearbox so that critical vehicle and/or gearbox conditions are prevented. For this purpose, according to a first embodiment, the gearbox control device is supplied with signals representing the direction of rotation of at least one 25 vehicle wheel. Preferably, the gearbox control device is supplied with a signal that takes into account the direction of rotation of several vehicle wheels. Thus, a plausibility check is carried out and the signals of vehicle wheels that have no ground contact and possibly spin in the opposite direction do not influence the gearbox control. According to a second embodiment, the gearbox control device is provided with a signal representing the direction of rotation at 30 the gearbox output. This signal is detected by a direction-of-rotation probe at the gearbox output. The use of this signal is advantageous since the direction of rotation at the gearbox output can result in the stalling of the engine which is prevented according to the invention by taking this signal directly into account.

According to a first embodiment, if it is detected that a vehicle rolls backwards, the supplied signal representing the direction of rotation of the wheels and/or the signal representing the direction of rotation at the gearbox output is used for switching to inverse gearbox torque curve. Preferably, the engine control is subsequently provided with a corresponding signal which then leads to the provision of a higher torque and thus prevents the engine from stalling when the vehicle rolls backwards on an incline. It is thus guaranteed that the drive unit of, for instance, off-road vehicles is kept stable. Moreover, there is no danger that functions supporting the driver, such as power-assisted steering and power brake, fail unexpectedly, which results in a greater security and availability of the vehicle.

Additionally or alternatively to this preferred embodiment, if it is detected that a vehicle rolls backwards, the vehicle brake is automatically actuated by the signal representing the direction of rotation of the at least one vehicle wheel or the signal representing the direction of rotation at the gearbox output. The speed of the vehicle is slowed down until it stops. As an alternative, the vehicle is merely slowed down until a minimum speed is reached at which the downhill force is lower than the gearbox drag torque so that the engine is prevented from stalling.

A further preferred embodiment refers to driving situations, in which a vehicle rolls backwards on an incline or a steep hill with forward speed being selected (gear "D") and in which a command to change up into the next gear would result in damage to the automatic transmission, for example by destruction of the overrunning clutch. According to the invention, in such driving situations, the provided signal representing the direction of rotation is used to prevent any change up into the next gear, preferably a change from 1st to 2nd gear.

A further preferred embodiment refers to the engagement of the reverse gear. Usually, a speed threshold is preset for the engagement of the reverse gear of the gearbox. In order to avoid damage to the gearbox, the reverse gear can usually merely be engaged below this speed threshold. According to the invention, if a vehicle rolls backwards on an incline, the provided signal representing the direction of rotation (of the vehicle wheel/s or at the gearbox output) is used to shift the speed threshold for the engagement of the reverse gear to higher speeds. This also improves the availability and security of the vehicle.

A further preferred embodiment of the present invention refers to vehicles that are equipped with a transfer box. According to the invention, the gearchange quality in such vehicles is improved by the fact that the signal representing the direction of rotation is considered. By the

5 use of the signal representing the direction of rotation, the individual gears can automatically be followed up in gear position N (only in this position is a change of the gear unit of the transfer box possible). Thus, the respective connection speed and consequently the gearchange quality is guaranteed.

10 The invention has the following advantages. First of all, the engine is prevented from stalling by taking into account the direction of travel of the vehicle – preferably by considering the direction of rotation of at least one vehicle wheel or the direction of travel at the gearbox output – and thus critical situations above all during off-road trips are avoided. Moreover, the reverse gear may be engaged even at higher speeds, which is also to mitigate critical

15 situations. Eventually, the automatic transmission is protected against any improper gearchange. The aforementioned advantages increase the security, service life and reliability of a vehicle and the number of possible warranty cases is reduced.

Claims

1. A method of controlling a vehicle gearbox comprising a gearbox control unit, characterised in that the direction of travel of the vehicle is taken into account in order to avoid critical vehicle and/or gearbox conditions.
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2. The method of claim 1, wherein the direction of rotation of at least one vehicle wheel is taken into account.
- 10 3. The method according to claim 1, wherein a signal representing the direction of rotation of at least one vehicle wheel is supplied to the gearbox control unit.
4. The method according to claim 1, wherein the direction of rotation of the gearbox output is taken into account.
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5. The method according to claim 4, wherein a signal representing the direction of rotation at the gearbox output is supplied to the gearbox control unit.
- 20 6. The method according to any of claims 1 to 5, wherein it is switched over to inverse gearbox torque curve by means of the signal representing the direction of rotation if it is detected that the vehicle rolls backwards.

- 25 7. The method according to claim 6, wherein the vehicle engine control is supplied by the gearbox control unit with a signal so as to provide a higher torque.
8. The method according to any of claims 2 to 7, wherein the vehicle brake is automatically actuated by the signal representing the direction of rotation if it is detected that the vehicle rolls backwards.
- 30 9. The method of claim 8, wherein the vehicle is slowed down until it stops.
10. The method according to claim 9, wherein the vehicle is slowed down to a minimal speed.

11. The method according to any of claims 2 to 10, wherein if the forward gear is engaged, a change to a higher gear is prevented by the signal representing the direction of rotation if it is detected that the vehicle rolls backwards.

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12. The method according to any of claims 2 to 11, wherein the speed threshold for the engagement of the reverse gear is increased by the signal representing the direction of rotation if it is detected that the vehicle rolls backwards.

10 13. A vehicle gearbox control unit that is suitable for carrying out a method according to any of claims 1 to 12.



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Claims searched: 1 to 13

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Patents Act 1977 Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK CI (Ed.T): F2D (DCD, DCG).

Int CI (Ed.7): F16H 59/66.

Other: ONLINE: WPI; EPODOC; JAPIO.

Documents considered to be relevant:

Category	Identity of document and relevant passage	Relevant to claims
X; Y	US 4676354 (JANISZEWSKI et al) see lines 22 to 66 col 2.	X: 1, 4, 5, 8, 9 and 13. Y: 11
X; Y	DE 3829024 A (AKEBONO BRAKE) see WPI Abstract Accession No 89-078086/11.	1 to 3, 8 to 10 and 13. Y: 11
X; Y	JP 030024360 A (JAPAN ELECTRONIC) see abstract.	X: 1 and 13. Y: 11.
X; Y	JP 010151000 A (FUJIMOTO) see abstract.	X: 1 and 13. Y: 11.

X Document indicating lack of novelty or inventive step
Y Document indicating lack of inventive step if combined with one or more other documents of same category.
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A Document indicating technological background and/or state of the art.
P Document published on or after the declared priority date but before the filing date of this invention.
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